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Energy Alberta 1988

Energy Resources Conservation Board
Review of Alberta Energy Resources in 1988

ERCB

The illustrations on the cover and in the front section of this year's Energy Alberta were done by Stan King, a Calgary illustrator and architect who— with co-workers Merinda Conley, Bill Latimer and Drew Ferrari— has developed a new approach to involving people in the design of their own environments. Mr. King's technique— called *Co-Design*— involves various kinds of communities in the co-operative and collaborative planning of a better way for gathering and visualizing the needs and concerns of people as major developments occur in their area.

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Energy Alberta

Each year **Energy Alberta** reviews energy developments within the province, seeking to place them within the context of both Canadian and world trends and developments. In addition to presenting statistical data not readily available elsewhere, this publication tries to provide some insights into what that data means for the people of Alberta, in both human and financial terms.

CANADIANA
JUN - 6 1989

Energy Alberta is published by the Energy Resources Conservation Board. The ERCB is an independent body which– in the words of its mission statement– "ensures the orderly, efficient, economic, safe and environmentally sound development of the energy resources of Alberta.

"In carrying out this mission, the ERCB must administer its statutes in a manner that is just and fair, and responsive to the needs and concerns of the Government and people of Alberta, and of the energy industry".

The editors and contributors to **Energy Alberta– 1988** trust that they have in some measure succeeded in explaining this complex mission. As always, we welcome and encourage reader input. Please contact: Editor, Energy Alberta, 10th Floor, 640 - 5 Avenue, S.W., Calgary, Alberta, T2P 3G4, 403-297-3596.

Oil

Gas

Oil Sands

Coal

Electricity

The colour bars above relate to specific energy resources. These same colours are used in charts throughout the publication.

Table of Contents

3 Important Events of 1988
6 This Community Called Alberta
14 Environmental Issues
18 Alberta's Energy Resources
37 Sales and Distribution
40 Revenues, Investment, Employment
42 Alberta Energy in Perspective
45 ERCB Operations

The 1987 gas plant garden party, held by Hewitt Oil to formally open its new sour gas plant in the Golden Spike area, west of Edmonton, proved to be an unusual "first".

Metric/Imperial Energy Equivalents

Energy	1 petajoule	=	energy equivalent of 164 000 barrels of crude oil
		=	energy equivalent of 1 billion cubic feet of gas
Oil	1 cubic metre	=	6.3 barrels
Natural Gas	1 cubic metre	=	35.3 cubic feet
Coal	1 tonne	=	0.98 long ton (2240 pounds) = 1.1 short ton
Distance	1 kilometre	=	0.621 mile

Important Events of 1988

Alberta energy industry sales were buoyant in 1988, despite a sharp decline in crude oil prices during the latter half of the year and continued uncertainty as Canada shifts from a closely-regulated to an open-market sales system. Production volumes of crude oil, bitumen, synthetic crude oil, natural gas, and gas liquids increased to the point where pipelines were operating at near capacity levels. Alberta's crude oil prorationing system was not required in 1988 and the crude oil market operated efficiently to move most of the available supply. In the case of natural gas, the province issued more removal permits than ever before.

Significant developments in 1988 included the announcement of a new Alberta Government ethane policy, completion of a major Alberta air quality study, development of new sulphur recovery and noise control guidelines for the province, and publication of a new long-term crude oil supply forecast.

Drilling in the province was the highest it has been since 1985, with more than 6600 wells drilled to year-end. It was also a busy year for proposed pipeline expansion, particularly for natural gas gathering and transportation systems.

The failure of OPEC members to adhere to their output quotas resulted in a sharp increase in crude oil supplies on world markets, and a subsequent downward pressure on prices. That downward pressure, in turn, resulted in several Alberta heavy oil and oil sands projects being slowed down or postponed, and significantly reduced exploratory drilling in the latter months of 1988. World oil supply and demand are expected to come more into balance by the early 1990s, with a subsequent improvement in prices.

Ethane Policy

The new Alberta Government ethane policy sets out how upstream and downstream users of ethane will share this valuable resource, which is vital to the manufacturer of petrochemicals (downstream user) and is also a major factor in the enhanced recovery programs being applied to Alberta's aging oil fields (upstream user). The ethane policy requires the drafting of new legislation and regulations. (See page 22 for further details.)

At year-end two new ethylene plants were under active consideration.

Air Quality Study

The completion of a 2-year Alberta air quality study, in 1988, is part of the on-going work of the Acid Deposition Research Program, which first began its work in 1983. This important biophysical research found that Alberta's air is generally of "pristine quality", but there is evidence of airborne pollution from the West Coast occasionally entering the province. The study also identified several areas of potential concern from Alberta-generated pollutants.

Sulphur Recovery to Increase

The new sulphur recovery guidelines, issued in September 1988, are designed to keep Alberta in the forefront of pollution control. The long-term objective is to limit atmospheric loading of pollutants to the extent practical. To this end, the new guidelines take advantage of improved technology and, for smaller plants, provide for a recovery of part of the costs from the Government's share of resource revenues. (See page 24.)

Forecasts Are Positive

ERCB's latest long-range crude oil supply forecast, developed in 1988 but not released until January 1989, is generally optimistic despite short-term concerns with the worldwide imbalance in demand and supply and the resulting decline in oil prices which occurred in the second half of 1988.

"Alberta Oil Supply, 1988–2003" suggests oil prices could remain weak for the next 2 years, but should begin to rise through the early-to-mid-1990s. On the basis of recent exploration activity and further geological analyses, the Board increased the probable ultimate potential supply of Alberta's conventional crude oil and pentanes plus. Notwithstanding that, potential production is expected to exceed the discovery of new reserves.

The Canada/U.S. free trade agreement, which came into effect in January 1989, is not expected to have a major impact on the energy industry, which has been largely deregulated over the last 5 years.

Crude oil is now marketed freely between shippers and producers. In the case of natural gas, the governments of Canada, Alberta, British Columbia and Saskatchewan agreed in October 1985 to work towards a deregulated natural gas market. Alberta's natural gas removal policy has had some major changes since then and continues to be reviewed in the context of North American market conditions.

Recovery in Coal Markets

Alberta's raw coal production and marketable coal deliveries increased substantially in 1988. This turnaround resulted from a combination of circumstances, including:

- Increased world steel output.
- Several closed mines elsewhere in the world.
- Increased Japanese purchases from Canada, to offset reduced deliveries from Australia.
- Widespread drought in North America, which affected the generation of hydroelectric power.

Sulphur Prices Recover

After falling below $70/tonne in June of 1988, sulphur prices rose rapidly to nearly twice that level before year-end. Sulphur stockpiles declined at a more rapid pace than in 1987, leaving less than a year's supply on hand by year-end.

Ammonia Joins Petrochemical Boom

Drought in 1988 caused world grain inventories to decline for the second successive year. The prospect of planting larger land areas in grain crops in 1989, particularly in the U.S. Midwest, has caused a run-up in ammonia prices and has led producers to operate near capacity. Methanol, ethylene, and ethylene-derivative producers also continued to produce at or near capacity during 1988.

Alberta Propane Invades Kansas

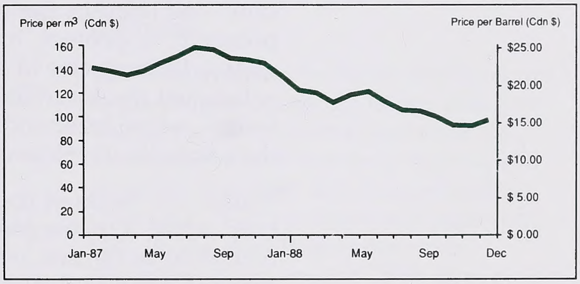
Record production of natural gas has resulted in dramatic growth in production of co-product ethane, propane, and butanes. At some sacrifice in producer price, the market interface between gas liquids from the U.S. Gulf Coast and from Alberta has moved southward from the northern Midwest into Kansas. Alberta propane now reaches Conway, Kansas via the Cochin and MAPCO pipeline systems.

Oil Patch's External Financing Declines

Total funds generated through external fund-raising by the oil and gas industry in 1988 were only one-third of the amount raised in 1987, a consequence of lower oil and gas prices as well as uncertainty in financial markets resulting from the October 1987 stock market episode.

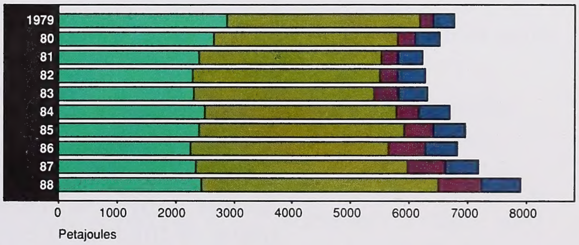
1. Alberta Weighted Average Field Price Light and Medium Oil

Oil prices topped $25 (Cdn) in July 1987, followed by a slow, steady decline until mid-1988. Prices had dropped below $15 by fall, before a recovery began in December.



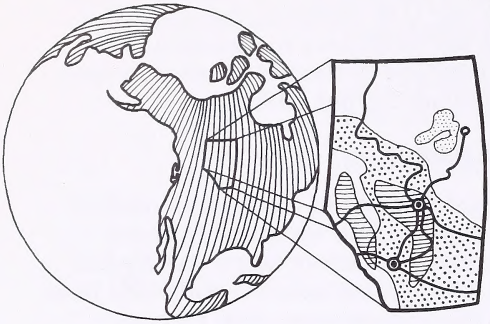
2. Alberta Hydrocarbon Energy Resources
10-year production

🟩 Oil
🟨 Gas
🟪 Oil Sands
🟦 Coal



This Community Called Alberta

Canadian communication specialist Marshall McLuhan's concept of the world as a global village may not yet be a full reality, but much of the world seems to be moving in that direction.



Many nations and people are today becoming increasingly aware of the organic nature of the world and how changes in one section of the web of life can and do have profound impacts in other areas. On the level of human interactions, many now see the world as a grouping of communities, rather than as separate nations.

Perhaps our own community—Alberta—also can be thought of as a grouping of still smaller communities within the larger world. Certainly, there is an increasing need for more effective relations between the various groups making up our Alberta community, as well as a need to develop new means for resolving our differences in peaceful ways that benefit everyone.

This shift in perspective, and the increasing awareness and concern of people about how energy developments affect their lives, has had a profound impact on all facets of resource development in Alberta, and on the agencies charged with regulating that growth.

ERCB Began as a Conservation Effort

The Energy Resources Conservation Board was set up in 1938 to conserve the oil and gas then being wastefully developed in the famous Turner Valley Field southwest of Calgary. The word "conservation"—as used in the Board's name —has many meanings: to preserve, to protect, to economize, to husband, to save, and to safeguard. Indeed, one of the Board's most important tasks today is to safeguard the interests of all Albertans by balancing public interest issues, while husbanding its storehouse of energy resources so that they may be developed and utilized efficiently.

Today, the focus of the Board still is on resource conservation. However, while a major part of its work continues to be scientific and technical in nature, over the past decade the Board has found a growing need to deal with the concerns of the broader Alberta community in its decision-making process.

So, while McLuhan's "global village" may still be a visionary concept for many, the need for new approaches to protection of the environment, and to achievement of sustainable economic development, are fast becoming apparent in many different parts of the world. Air, water and soil pollution, the possible health effects of resource development, and the disposal of hazardous wastes are among the issues concerning citizens, communities, industry, and regulatory bodies almost daily now. These kinds of concerns are clearly reflected in many of the recent energy development decisions of the ERCB.

The growing interdependence, and an overlapping interest in these issues, has also affected the role of industry. It has prompted, for example, increasing co-operation between various companies and organizations when working on projects such as Alberta's internationally recognized Acid Deposition Research Program (ADRP).

Demonstrating the growing concern of the Alberta Government and the province's energy companies, the funding for the ADRP was provided jointly by Alberta Environment, the Canadian Petroleum Association, the Energy Resources Conservation Board, and Alberta's electric utilities (TransAlta, Alberta Power, and Edmonton Power).

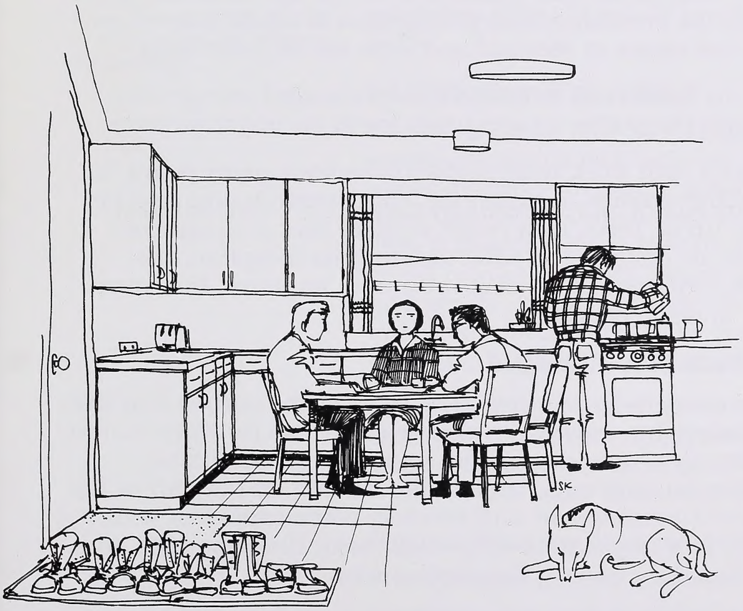
The ADRP biophysical study,"The Present and Potential Effects of Acidic and Acidifying Air Pollutants on Alberta's Environment", was completed in 1988 after 2 years of intensive field work. While the study found no major regional air pollution concerns in Alberta at this time, the detailed results definitely will help all parties involved in industrialization to understand some of its environmental effects.

Stakeholders Working Together

These changes in public perceptions and concerns have led to an increasing Board involvement with many different publics, and to a conviction to support efforts to improve communications between all of the energy development stakeholders. It also prompted a greater focus by the Board to search for alternatives to the public hearing process to resolve some of the disputes.

The Board believes these changes are beginning to show up in the many industry/government/community committees now working together to resolve both new and long-standing concerns. The changes are apparent, too, in the way major research projects– such as the 1988 gas-plume dispersion study near the central Alberta community of Kathyrn– are being explained to the media and to the communities where the field work is taking place.

They are visible, too, in the tough environmental and human safety restrictions now being imposed on companies through the ERCB's approval decisions for sour gas wells, particularly in environmentally sensitive areas such as Caroline and Northeast Calgary, and at Prairie Bluff and Whitney Creek in the Waterton area.



The vast majority of oil patch arrangements are successfully carried out around a kitchen table, over coffee.

Concerns Date Back to 1970s

The beginnings of today's concerns regarding the potential environmental impacts of Alberta's energy developments date back many years. Some of the more innovative approaches to dealing with these concerns began in the mid-1970s, when projects such as TransAlta's Keephills power generating plant, 80 kilometres west and south of Edmonton, were in the very early planning stages. It soon became apparent that development of the huge coal mine required to supply the Keephills generating plant would actually displace the nearby community of Keephills. That concern, fuelled in part by an even earlier Alberta Government decision not to allow a power plant in the Camrose area for environmental reasons, led to development of a joint program by the utility and the community to plan the relocation of the hamlet of Keephills. From all accounts, this major involvement of people was a success.

An increasing recognition of the public's right to become involved as a major stakeholder in energy development decisions was apparent again a few years later, when the coal industry began seeking permission to open new mines in the Rocky Mountain Foothills, particularly in the old mining area southwest of Edson known as the Coal Branch. This is a spectacular part of the province, with great potential for future tourism development, and Manalta Coal went to unusual lengths to explain the environmental precautions it would take when developing new coal mines at Mercoal and near the McLeod River.

In recent years, the Board has consistently encouraged energy companies to meet with the public to seek their input on major projects.

Some of the Board's own work with people dates back many years. In the case of the ADRP studies, for example, that research organization originally was set up in 1983, as a result of more than a decade of previous study on air pollution in Alberta. From its inception, the ADRP has been a combined effort of government, industry, the scientific community, and the people.

Development Path Has Changed

Gradually, it has come to be recognized by most of the parties that the issues to be considered in energy developments in this province had to be broadened. Twenty years ago a major energy project could be approved with little interest and virtually no concern on the part of the public. Today, direct involvement and two-way communication with the general public is a requisite in almost all major developments and this demands a broader vision of the implications.

Without question, major philosophical shifts in how to deal with public participation had occurred globally during the 1970s.

In those jurisdictions where this broader path to energy resource development has been successfully followed, it has most often led to speedier and more frequent resolution of issues and concerns, and to a reduction in the tensions which commonly occur between development companies and the people affected by their developments.

The successful work of the Ft. McKay Interface Committee has made energy industry visits a normal part of daily life in that northern Alberta community.

During the past decade, the Board has tried a number of different approaches to the resolution of disputes and to provide the affected parties meaningful input to the decision-making process. A few examples where this has proven to be quite successful are outlined below.

Fort McKay Was a First

The work of the Fort McKay Interface Committee, which serves as a communications link between the native peoples in that area and major oil sands developers Syncrude and Suncor, with assistance from the ERCB and various departments of the Alberta Government, clearly demonstrated that decision-makers representing all parties could resolve complex issues and bring about environmentally safe and people-sensitive energy developments. It has also allowed outstanding concerns to be resolved without the need for confrontational public hearings.

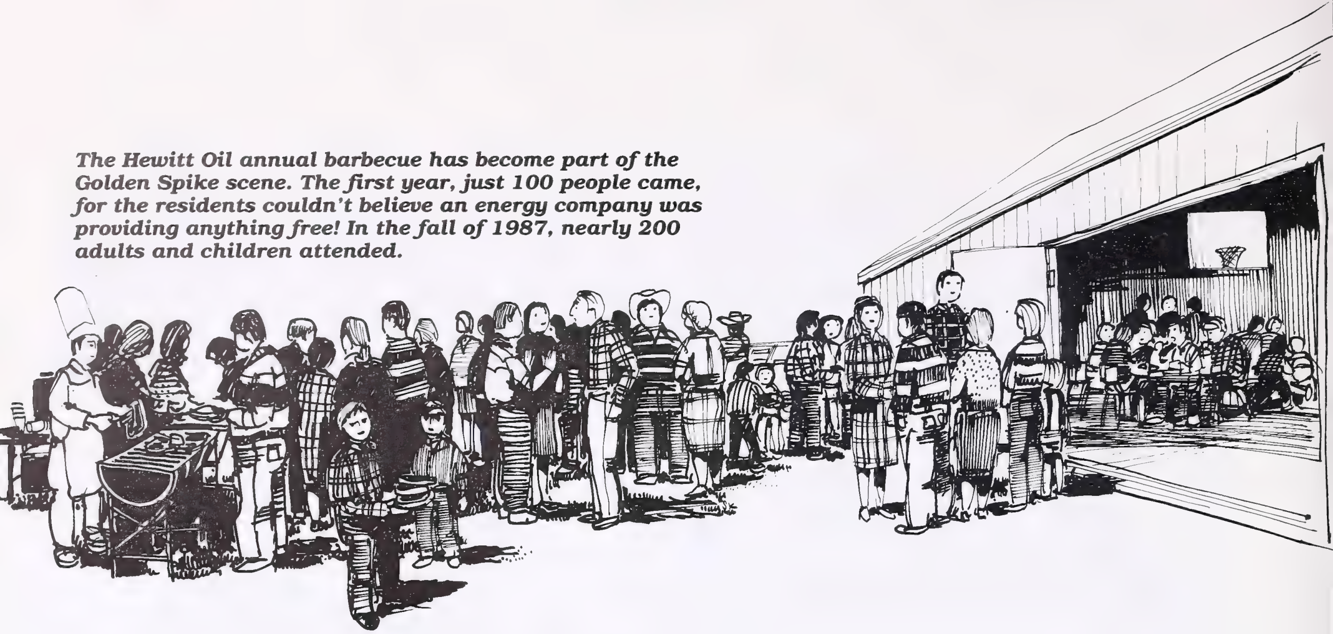
This powerful industry/government initiative now is regarded internationally as an outstanding example of how people-sensitive companies and governments can work to efficiently develop energy resources while, at the same time, improving the lives of people living nearby.

Hinton Was an Involvement Textbook

The sensitive community work of Canadian Superior Oil when that company proposed to drill a sour gas well near the town of Hinton demonstrated how an entire town could become usefully involved in the planning associated with drilling a critical sour well.

Indeed, it was during the excellent work in Hinton that the ERCB first came to know of Dr. George Kupfer, who was then a consultant to Canadian Superior. Today, Dr. Kupfer is employed by the Board as its adviser on public and community involvement.

The Hewitt Oil annual barbecue has become part of the Golden Spike scene. The first year, just 100 people came, for the residents couldn't believe an energy company was providing anything free! In the fall of 1987, nearly 200 adults and children attended.



Golden Spike Proved the Point

It was during this same period that the Hewitt Oil/Golden Spike experience came along to strengthen the Board's resolve in the search for a better way to mesh resource development with the aspirations of communities and people. Golden Spike proved to be a solid lesson in all the things that can go wrong when the traditional energy development path is followed through a residential area filled with environmentally conscious, deeply concerned citizens.

Tom Hewitt Jr., company vice-president, explains: "As a company we were committed to going down the road to an ERCB public hearing, from which we knew would come a decision on whether Hewitt Oil could build a small sour gas processing plant in an area of acreage homes. That was the traditional way and the only way we knew.

"Frankly," Mr. Hewitt continues, "it never occurred to us to involve local people in planning the plant. After months spent trying to answer public questions and concerns, we went through a very angry and expensive ERCB hearing. It was nearly 18 months before we finally received permission to build our plant. Soon afterwards it occurred to me that while we had won the battle, we might just be losing the war! No one in the area liked us and we weren't seen as being good neighbours. Yet it was clear that we were hoping to be in the neighbourhood for many years."

Even though he had already received ERCB's approval to build the gas processing plant, Tom Hewitt made the decision to try another way. He led his company back along the traditional road already travelled, repairing his relationships with the local residents at each stress point he uncovered. That accomplished, Hewitt then set off down a new road towards active involvement with local people, including various kinds of community support, active participation on community discussion groups, and a number of "good neighbour" activities such as the now-annual Hewitt barbecue and dance.

Today, Hewitt Oil is known throughout the Golden Spike area as a caring and courteous corporate citizen. As one might expect, there still are people living in the area who wish the Hewitt plant wasn't in the neighborhood. But almost everyone now agrees that Hewitt Oil is a good corporate resident. The difference has been almost totally brought about by face-to-face communication and close involvement between the company and the people living in the Golden Spike area.

Alberta: Canada's Energy Storehouse

This province's huge storehouse of energy resources provides Albertans with one of the highest standards of living in the world. To the credit of all Albertans, we have for the most part managed to develop these resources without destroying the natural beauty and scenic wonders of the larger community.

In the early years, Alberta's population was small and energy developments had little obvious impact on our way of life. Today, as our population increases and developments of all kinds move closer to our homes— and, incidentally, as our homes move closer to those developments— public concerns over conflicting space and resource use are growing dramatically. Resolution of these conflicts to the benefit of everyone is vital if the Alberta "family" is to continue living comfortably, productively, and happily in its home community.

Successful management of the larger Alberta "household" requires much skill and knowledge, and the careful co-operation of all members of the "family". The need for improved communication, and increased involvement between developers and other Albertans, is today one of the most important challenges facing this province and its people. And perhaps nowhere is that need more readily apparent than in the development of Alberta's energy resources.

The plans of oil patch developers often are first expressed to the landowner across the hood of a pick-up truck.

Because the ERCB has evolved into something of a middle man in energy developments, the Board and its staff must equally serve all Albertans, be they representatives of government or industry, of special interest groups or concerned citizens. This co-operative approach to energy developments has resulted in a number of significant changes in recent years, several of them introduced during 1988.

For example, working with the energy industry in1988, the Board, with the assistance of Alberta Environment, developed new noise control guidelines to help reduce that troublesome source of friction between energy companies and the communities in which they operate.

In its regulatory capacity— but again working with the energy industry, and with the advice and counsel of citizen volunteers— Alberta Environment and the Board, in 1988, issued new sulphur recovery guidelines to help reduce sulphur emissions from Alberta's sour gas plants.

Following the 1982 Lodgepole blowout, new regulations and operating procedures were developed by the ERCB, the petroleum industry, and public representatives working co-operatively to reduce the chances of another major sour gas blowout occurring in the province and to minimize the risks should such a blowout ever occur again. Out of that work a new emergency contingency program was developed. This provincial emergency communications and response program is widely acknowledged to be one of the best in North America.

Change Can Be Threatening

This increased emphasis on public involvement and communications does have its drawbacks, however. Change of any kind often is threatening to many, and frequently it is fought just because it is change. Also, it is never easy to anticipate problems, or to offer solutions before problems develop. Moreover, it is an expensive and time-consuming process for all. However, the Board believes that the investment of time and money will pay dividends in the long run. The Board believes that the early involvement of the people and the industry, plus effective two-way communication between all the parties, should work to shorten and make more pleasant the total developmental process. As well, broader and earlier input into the developmental planning process— especially by directly affected citizens— will result in better decisions being made to the ultimate benefit of all.

There are, of course, many more complex issues which involve the energy industry with this community called Alberta. The ERCB is involved in many of these. In some instances, the Board is the primary agency; in others, it works co-operatively with various Provincial Government departments, including Alberta Environment, Forestry, Lands and Wildlife, and Alberta Energy.

Energy No Longer Isolated

Clearly, economic developments– including energy developments– no longer can be considered in isolation from the impacts they may have on the broader community. Increasingly, there is need for long-term planning, for detailed socio-economic and environmental impact assessments, and for carefully considered input from all those affected by the projects being proposed.

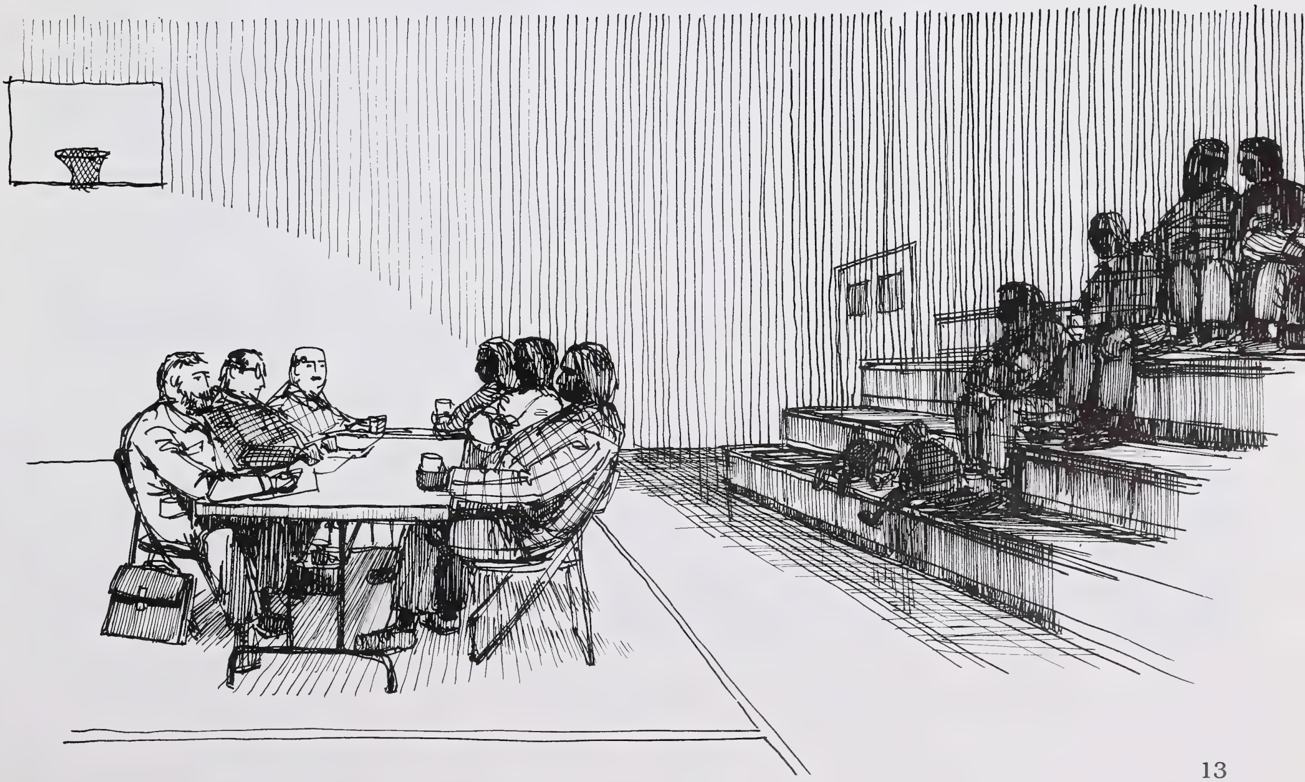
ERCB Is Involved

As we noted earlier, much of the Board's work has been in the past, and still is today, of a highly technical nature. For many years, its staff had little contact with the general public. However, in today's complex society, ERCB staff more and more often find that they are reaching out to become involved in the broader Alberta community.

One of the most significant "learnings" to occur out of developer/native interactions is that "chief" is a white man's word. The native groups truly practice grass roots decision by consensus. And, the keys to consensus frequently are seated on the sidelines, watching and listening, rather than at the table.

Possibly this philosophy was best expressed by former Board Chairman Vern Millard, when he wrote back in early 1983, "Most of the senior management people in the Board now accept that the ERCB is no longer a pristine technical body that deals in a rather exclusive manner with industry, but instead is a regulatory agency that is deeply involved with public issues and operates in the public's 'fishbowl'. These new relationships make it mandatory that (our) communication with the public be both effective and competent."

Today, that philosophy remains as a primary challenge for the Board and its staff.



Environmental Issues

Protection of Alberta's environment cuts across a broad spectrum of ERCB activities, with a number of significant activities taking place during 1988.

During the year, Board staff played major roles in the joint industry/ ERCB gas dispersion study, the pre-hearing public meetings of the Caroline gas play, work in the proposed expansion of the Waterton Gas Field, and in provincial emergency response planning.

Other work of importance included the development of new noise and sulphur recovery guidelines for the province, and the Board's continuing interface with various government departments, such as Alberta Environment and Forestry, Lands and Wildlife.

The Board continues to be involved in on-going discussions with industry on how best to protect the environment, particularly in such high-profile areas as the drilling and production of sour gas.

Another concern— one that is becoming increasingly important— is the handling and disposition of hazardous wastes by industry. The ERCB has a major involvement in the development of a new set of drilling waste treatment and disposal guidelines, the development of policies respecting treatment and disposal of other oil field wastes, and approval of oil field waste treatment and disposal facilities. The ERCB has also been involved with Alberta Environment in defining those materials which require specialized handling (such as delivery to the Swan Hills Hazardous Waste Plant) and those which may be treated as conventional oil field wastes.

The Board also worked with industry on development of the Canadian Petroleum Association's new Code of Environmental Practice.

Protection of the high-altitude ozone layer, which helps shield the earth from harmful cosmic radiation, and minimization of industrial pollution from low-level ozone and other products of hydrocarbon combustion, are global concerns which impinge directly on Alberta. The ERCB has been assisting Alberta Energy and Alberta Environment to assess the situation and its potential effects on Alberta and Canada.

During 1988, a study entitled "The Present and Potential Effects of Acidic and Acidifying Air Pollutants on Alberta's Environment" was released. This baseline study, funded by the ADRP, shows Alberta does not have a regional-scale air pollution problem at present, but pinpointed some future areas of potential concern. Work such as this will help in planning to minimize the potential negative impacts of industrialization.

Major Gas-plume Dispersion Studies near Calgary

Over the years, the Board, and many Albertans, have become increasingly concerned that public safety be given the highest consideration in the on-going development of sour gas facilities near urban centres.

Scientist with monitoring vehicle, records path and behavior of simulated gas release, during ERCB's 1988 field measurement program conducted northeast of Calgary.

To assist in its future evaluations, the Board commissioned Concord Scientific Corporation to develop two computer models, GASCON and GASRISK, to predict what would happen in the event of hydrogen sulphide (H_2S) or sulphur dioxide (SO_2) releases.

The GASCON (Gas Concentration) model predicts concentrations downwind; the GASRISK model will predict what the likely public risks will be in the event of a blowout or pipeline rupture. GASCON provides much of the data for GASRISK.

Because these are simulation models, there was some public debate about ensuring the accuracy of their forecasting ability. It was decided, therefore, to do a field study using a non-reactive, odourless gas, sulphur hexafloride or (SF_6), which has behavioural characteristics similar to SO_2 and H_2S.

The field study was designed to identify the worst-case circumstance; that is, the impact of such a release on flat land, with low wind speed and stable atmospheric conditions. Approximately 50 hours of good data was required to properly assess the model.

Funding for this work was provided by the oil and gas industry, with some assistance from the major electric utilities. The Board directed the work and provided most of the manpower. Also, a number of local individuals and energy companies, as well as Alberta Environment, contributed to the program in a substantial manner.

The first step was to locate a sufficiently large flat land area on which to conduct the study. The ERCB was fortunate in gaining the hospitality of Kathyrn-area landowners, Harold and Marian Randall, who strongly supported this kind of testing. Once that was done, the fields were marked off in grids with stake markers; gas release points were established and equipment was assembled.

Under the Board's direction, a very comprehensive communications plan was implemented in connection with this study. This included distribution of four newsletters, dozens of face-to-face visits with residents in the area, and a major media tour of the test site.

There were two types of gas release source. A snowblower fan, which had been used during the Calgary Winter Olympics, was used to simulate an elevated release, while a smaller fan was used to simulate a ground release. Both fans could simulate a well blowout or a pipeline rupture.

Two types of releases were necessary because the SF_6 is colourless. A visual release, using smoke, was run for 15-minute intervals to give a general idea of what was happening. Then, actual SF_6 gas releases were run and were monitored at different distances, using three trucks with sensing equipment and on-board computers. In addition to a field office, there was also a sophisticated weather monitoring station at the site. The monitoring station will remain in place and operational for a year, in order to continue gathering invaluable weather data.

Set-up of the Field Measurement Program began in September 1988, with actual monitoring under way by October. The tests were completed just before Christmas 1988, although site clean-up carried on into January 1989.

The Board had ten people working on the project, seven of them full-time, with contractors and locally employed residents adding another eight people. The study was governed by the weather, of course, and staff had to adjust their schedules accordingly. Since the ideal test conditions usually occurred in the evening and late at night, most shifts began about 4 p.m. and ended around 2 a.m.—although crews sometimes worked until 5 a.m. when weather conditions were favourable.

During the early part of 1989, the data gathered will be used to check what actually happened against what was forecast by the GASCON model. The results then will be used to fine-tune the GASCON model.

Noise Can Be a Concern

New Noise Guidelines, introduced by the ERCB in late 1988, will help head off potential conflicts between the energy industry and communities in which it operates.

The concern in developing the new guidelines was with noise pollution as a nuisance factor and not with the health and safety aspects of noise, which are considerations of Alberta's Department of Community and Occupational Health.

Noise levels that endanger health are considerably higher (starting at 85 dBA/hour for an 8-hour day) than the ERCB's noise guidelines, which can begin as low as 40 dBA, depending on the ambient or background noise levels.

The new guidelines also adopted a sound equivalent level (Leq) approach. What this means is that sound is monitored over a specified time period and then averaged to determine the Leq level. This is based on a minimum 6-hour survey and, hopefully, accurately reflects the situation in a given area.

The new guidelines require the noise measurement to be taken at the location of the concerned resident, such as a nearby farmhouse.

There is no requirement to monitor existing facilities unless concerns are expressed by local residents. The Board expects all new facilities to be designed to meet the guidelines. The cost of implementing noise control measures at a new facility are much more reasonable than retrofitting. For instance, by turning a compressor building 90 degrees, the noise from cooling fans can be directed away from a nearby residence.

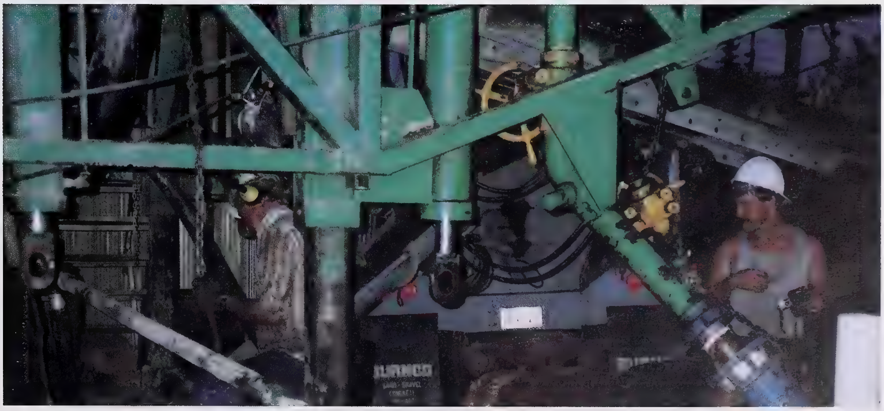
Under the old guidelines, permissible sound levels were 50 dBA for night-time conditions and 65 dBA for day-time conditions, regardless of where the facility was located, or the background noise.

The new categories, which take into account background noise levels, begin as low as 40 dBA for night-time in quiet areas. While the Board recognizes that this is a significant drop from previous guidelines, it believes new technology is available to cope with any concerns.

A quiet office or living room (or the public library) generates sound levels of about 40 dBA. A moderate rainfall, a quiet street, or the inside of an average urban home will generate about 50 dBA, while a noisy office or a normal conversation at about 3 feet generates 60 dBA. A clothes dryer will generate 51 to 65 dBA at 3 feet, while the sound level of an air conditioner is about 50 to 67 dBA, and an electric shaver will run 47 to 68 dBA.

The new guidelines were developed by experts from industry, provincial noise consultants, academics from the University of Alberta and the University of Calgary, Alberta Environment, and Municipal Affairs, assisted by public representatives. Indeed, they even involved a “noise psychologist” who examined the impact of different kinds of noises on people even when played at the same noise level. For example, Bach being played at 40 dBA is quite acceptable “noise” for most people, but the recording of a baby crying, played at 40 dBA, is a “noise” few can ignore.

These guidelines are believed to be some of the most advanced in Canada. However, to ensure that Alberta remains on the leading edge of this technology, and to be certain that the new guidelines continue to be reasonable, the Board has agreed to review them again in September 1990.



Alberta's Energy Resources

Alberta continues as Canada's major energy source, having more than 77 per cent of the nation's reserves of conventional light and medium oils, 91 per cent of its conventional natural gas, 100 per cent of its oil sands/bitumen reserves, and 56 per cent of its coal. In this section of Energy Alberta we explore how much of Alberta's energy reserves have been developed, produced, and marketed, and how much remains.

3. **Alberta's Energy Resources** (in petajoules)

Remaining reserves at the end of 1988	Conventional Oil and Equivalent	22 400
	Natural Gas and Equivalent	63 000
	Bitumen and Synthetic Crude Oil	153 000
	Coal	573 000
1988 Marketable Production	Conventional Oil and Equivalent	2 450
	Natural Gas and Equivalent	3 200
	Bitumen and Synthetic Crude Oil	735
	Coal	640
	Hydro	5

		To Alberta	To Other Provinces	Exports	**Total**
1988 Sales	Crude Oil and Equivalent	710	1 265	1 210	3 185
	Gas	700	1 120	1 380	3 200
	Coal	420	40	180	640
	Hydro	5	0	0	5
	Total	**1 835**	**2 425**	**2 770**	**7 030**
	Per Cent of Sales	26	35	39	100

Conventional Crude Oil

Alberta's conventional crude oil production in 1988 amounted to about 57.5 x 10^6 m^3, approximately 7 per cent higher than the previous 2 years. This increase resulted from increased levels of drilling, expanded pipeline capacity, and the June 1987 implementation of the Modified Crude Oil Prorationing Plan, which permitted a free market approach to oil sales. Also, the New Oil Well Production Test Period, which began in the latter part of 1987 and allows all new oil wells a minimum oil production rate of 20 m^3/day for the initial 4-month test period, had a positive effect.

On the supply side, a recent ERCB report entitled "Alberta Oil Supply, 1988-2003" suggests that the estimated ultimate potential of conventional crude oil reserves in Alberta will be some 10 per cent higher than previously expected. The ERCB now estimates that ultimately 2905 x 10^6 m^3 of recoverable oil will be discovered in Alberta, of which about 2200 x 10^6 m^3 (75 per cent) already has been found.

While this prospect of new reserves is significant, new discoveries are unlikely to be sufficient to reverse the long-term decline in Alberta's proven reserves of conventional crude oil. Oil pools yet to be discovered are expected to be smaller and more expensive to find and produce. Therefore, continued effort to optimize recovery from existing pools through secondary and tertiary enhanced recovery schemes is vital to the province.

The ultimate potential of pentanes plus, although only a small portion of total potential oil reserves, now is 34 per cent higher than forecast in 1985, largely because of the discovery of the Caroline natural gas field, and the expectation that higher recovery factors also will occur in the future.

Drilling activity was up significantly in 1988. A total of 2280 successful oil wells were drilled in Alberta during 1988, of which 23 per cent were exploratory wells and the remainder development wells.

Nine applications for experimental horizontal oil wells were approved by the ERCB in 1988. As a result of improvements in equipment reliability and directional control, horizontal wells have recently attracted greater interest in Alberta. These wells are typically more expensive and difficult to drill, but reduce either water or gas coning which, in turn, increases productivity.

Pressure maintenance has been a major focus of the Alberta oil industry for many years. This trend continued during 1988 with the filing of 44 applications for new enhanced oil recovery schemes.

Oil Sands

While Alberta's huge reserves of oil sands and heavy oils are seen as the main source of a secure oil supply in the future, many of the planned projects were affected by the sharp decline in oil prices that occurred in the latter half of the year. Despite that, work continued on a number of fronts.

Such developments include approval of the Syncrude expansion, start on the Suncor debottlenecking project, and approval in principle between OSLO and the Federal and Provincial Governments to proceed with a $4.1-billion oil sands project at Kearl Lake.

As well, OSLO conducted an experimental dredging and bitumen recovery scheme using cold water at a site just north of Fort McMurray. Additionally, production began from the Alberta Oil Sands Technology and Research Authority's UTF (Underground Test Facility) shaft and tunnel project, which is adding significant new technology to operations in the Athabasca oil sands.

Also during the year, the Board was involved in discussions with Solv-Ex regarding a potential commercial oil sands mining scheme, with possible extraction of saleable amounts of gold, silver, and titanium.

In late 1987, Suncor reached an agreement with the province to increase the capacity of its Fort McMurray plant. This project, called the Suncor debottlenecking project, was delayed by a major fire which resulted in reduced production until February 1988.

Effective communication and direct involvement with the public have become increasingly important for the ERCB's oil sands activity.

Several approaches have been tried, including the Fort McKay Interface Committee and its Application Review Team (ART) process. These groups have been set up by industry, the Government, and residents to deal with local community concerns about the impacts of development. The major issues confronting these groups are how to develop the resource without undue impact on people and land, or on air and water quality.

Discussion with the Board regarding this project prompted the formation of the Suncor Debottlenecking Application Review Team (DART). This team consists of representatives of Suncor, the Fort McKay Indian Band, the City of Fort McMurray, the ERCB, plus several government departments (Alberta Environment, Forestry, Lands and Wildlife, and Occupational Health and Safety). The DART members have been meeting regularly to discuss and resolve concerns.

The ART process, which was pioneered with the Syncrude mine and plant expansion application, also will be used to deal with the OSLO project, commencing in 1989.

There were a number of new activities during 1988, at *in situ* projects in Athabasca and in the Cold Lake/Primrose and Elk Point/Lindbergh areas. These include Suncor's Burnt Lake project, a proposal by BP Canada to test *in situ* combustion as a follow-up recovery method to cyclic steam injection at its Wolf Lake commercial project, and horizontal well tests by Amoco and Gulf at experimental projects in the Wabasca area.

With all this development has come an increase in concerns expressed by residents. Working with Alberta Environment, the ERCB has become heavily involved in odour investigations centred on the Fort McMurray area.

Initially, efforts were focused on H_2S and $S0_2$ emissions. At both plants, H_2S sources were detected, quantified, and reduced or eliminated. $S0_2$ emissions were reduced by improvements to sulphur recovery equipment.

The most prevalent odours currently appear to be due to hydrocarbons emanating from settling ponds, and from the upgrading plants and mines. Sulphurous odours from elevated stacks, also are contributing.

Suncor has recently installed equipment to scavenge hydrocarbons from the tailings which empty into its settling ponds. Syncrude has been processing the tailings from its plant for about 3 years.

The objective at both plants is to increase the recovery of oil and to decrease the amount of volatile material which can escape from the ponds through evaporation.

Water use by *in situ* projects is another major concern, particularly in the Cold Lake-Bonnyville area. Groundwater and lake levels throughout Northeastern Alberta have been dropping in recent years, and area residents believe this is due to increased water use by oil sands projects. As a result, some companies have experienced long delays for approval of water supply for test projects.

Working with Alberta Environment, the ERCB is developing new industry guidelines for water recycling at *in situ* oil sands schemes. These will require all produced water to be recycled, unless there are particular technical or economic constraints.

A proposed 16-inch pipeline from the North Saskatchewan River is scheduled for construction in 1991. It will alleviate industry problems by providing a supply of fresh water to the area.

Esso Resources plans to complete the newest $200-million processing plant at its Cold Lake complex, but it has suspended field work on Phases 7-10 of the same project, and delayed new plant start-up until the price outlook for oil improves.

Suncor has slowed its $200-million debottlenecking project at the company's Fort McMurray oil sands plant, slowed its Burnt Lake project, and proposed abandoning its Fort Kent experimental project.

Murphy Oil has suspended work on its $33-million heavy oil project near Lindbergh; so has Canadian Occidental on its $15-million Manitokan project.

BP and Petro-Canada are continuing work on their joint $200-million expansion at Wolf Lake, near Bonnyville. These processing facilities are scheduled for completion in the spring of 1989.

Venting of gases and land disturbance during exploration and development are other issues of concern which the Board has been studying with Alberta Environment. In the Lindbergh area, for example, much of the exploration and development work had been done on a single-well basis, the normal practice in the conventional oil industry. However, the Board is now encouraging a production pad concept, as pioneered at Cold Lake. For recovery purposes, the Board believes that pads, with a series of directionally drilled wells, are more effective in minimizing land disturbance, facilitating the gathering of production fluids, recovering gases, and increasing the energy efficiency of thermal projects.

The practice for exploration and/or delineation wells has been to step out with single wells. This approach results in considerably greater surface land disturbance. It is also more difficult to collect and flare vent gases from single step-out wells, and that, in turn, creates odour problems and triggers complaints from the public. A task force of ERCB and Alberta Environment staff has recently developed guidelines to address this issue, which will be discussed with industry.

Natural Gas

The natural gas industry has been very active during 1988, with the ERCB involved in such major projects as a review of gas removal permits, the implementation of new ethane recovery policy, and the development of new sulphur recovery guidelines for the province.

Gas Removal Permits

The ERCB, Alberta Energy, and the Alberta Petroleum Marketing Commission, at the request of Cabinet, are reviewing the provincial gas removal permit system, with recommendations on changes expected by mid-1989.

The Alberta Gas Resources Preservation Act has two objectives: protection for future Alberta requirements for natural gas, and optimization of the public interest benefits to Albertans from natural gas sales. In keeping with these objectives, the review is focusing on four major issues: 1) How to best protect Alberta's future requirements for natural gas; 2) How to best optimize the benefits of natural gas sales; 3) The treatment of reserves available for permitting purposes; and 4) Maximum term of permits.

These issues continue as major considerations in the current review.

Ethane Policy

The Alberta Government, in late 1988, issued a major policy statement on ethane, including who will have extraction rights to this important commodity.

That policy statement resulted from the growing conflicts between upstream gas producers and downstream users, principally straddle plant owners and petrochemical manufacturers.

Natural gas is comprised primarily of methane, but includes a number of other potentially useful products. Up to the early 1970s, the main components extracted from the gas in Alberta were propane, butanes and pentanes plus. Ethane, another constituent of gas, is used primarily for the manufacture of ethylene, the basic building block for about 60 per cent of the world's petrochemicals.

However, as technology improved and the world markets for plastics and other petrochemicals expanded, it became attractive to extract ethane from gas in Alberta.

Five straddle plants were built along the major Alberta gas pipelines to extract the ethane. The Alberta Gas Ethylene Company Limited (AGE) was set up as a subsidiary of NOVA Corporation of Alberta. AGE's mandate was to manufacture ethylene at a plant near Joffre, a few miles northeast of Red Deer.

Ethane and ethylene sales were guaranteed for AGE by Dow Chemical Canada Inc., with some ethylene being converted to petrochemicals at Dow's expanded Fort Saskatchewan facilities and some being shipped east along with ethane in the Cochin(1) pipeline. As markets expanded, so too did the various Alberta facilities related to this facet of the petrochemical business.

In the 1980s oil companies also found a valuable use for ethane. A hydrocarbon solvent such as liquid ethane can achieve a very high level of displacement efficiency and ultimately increase the recovery of more oil than under other forms of enhanced recovery.

Ethane is preferred as the primary component of hydrocarbon solvents used in miscible flood schemes.(2) Beginning in 1981, gas producers began applying to the ERCB to extract ethane for use in miscible flooding. These producers either had their own miscible flood projects or they saw this area as a potential market for ethane.

All but one of these applications were approved by the Board because the overall benefits to the province were seen as outweighing the costs. This was true notwithstanding increased costs to downstream users. However, these Board decisions then led to strenuous objections from straddle plant and petrochemical plant owners.

Beginning in early 1987, both upstream and downstream interests began lobbying for a solution to the problem. In August 1987, the Alberta Government issued a policy position paper and asked the Board to consider ways of implementing it. The Board, in consultation with the affected parties, concluded that a public inquiry was necessary, and one was held in late 1987. Meanwhile, as a result of the review, several upstream and downstream projects had been put on hold.

In April 1988, the Board issued Decision Report 88-D, giving its recommendations. In the fall, the Government issued a formal statement regarding implementation of the policy.

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(1) *Today, the Cochin pipeline carries ethylene and propane to Central Canada and the U.S. Midwest, where they are used in various industrial processes. A small amount of ethane is used as a buffer in the Cochin, between batches of ethylene and propane.*

(2) *Miscible flood: a process by which more of the oil in a reservoir may be brought to the surface. For the lay reader, a miscible flood may be likened to dry-cleaning a suit stained by oil. With water alone, the oil won't come out of the material; with a miscible solvent applied to the oil, it will come away from the material. Likewise does a miscible flood solvent, such as ethane, free more oil from the formation in which it is trapped.*

The new ethane policy requires certain legislative and regulatory changes, but will have the following key features:

1. On the downstream side, the ethane supply to facilities built before the policy came into effect is protected; on the upstream side, continued access to gas and its accompanying ethane content is ensured for producers who built field plants before the policy came into effect.
2. A threshold volume (TV) of ethane, based on servicing existing petrochemical plants— and including the buffer requirements in the Cochin pipeline, has been guaranteed. Future approvals issued to producers to extract ethane in the field, will carry a proviso that, should total ethane supply at the straddle plants drop below the threshold volume, the involved parties will negotiate for sufficient of the resource to make up the TV. Should negotiations fail, the ERCB would order new upstream plant operators to reinject ethane into the gas stream, or otherwise supply ethane to the straddle-plant system.
3. Expedited processing of field plant applications will occur if the producer can show that its plant will not cause the TV to be breached, and that it is otherwise acceptable.
4. The policy will remain in effect as long as contracts for ethane from the straddle plants meet or exceed the TV.

In early 1989, the Board sent a draft Information Letter, respecting the details of implementation, to industry for comment. It is anticipated that the Board will finalize these details by the end of the second quarter of 1989.

Sulphur Recovery Guidelines

In September 1988, the ERCB and Alberta Environment jointly issued strict new sulphur recovery guidelines for the natural gas industry, even though this industry already recovers 98 per cent of its sulphur.

Although extensive studies over the past 5 years show that Alberta has no significant air pollution problems at this time, the ERCB and Alberta Environment decided to further tighten emission controls reflecting increasing concerns about air quality and newly available technology that reduces emissions. Alberta's long-term objective is to limit atmospheric loading of pollutants to the extent practical.

Sulphur recovery guidelines have been in effect in Alberta since 1971. This latest revision follows an extensive review by an ERCB/Alberta Environment task force, plus input from both industry and the public.

The main change involves plants processing less than 10 tonnes a day of sulphur. Plants of this size previously were not required to recover sulphur because of their limited potential impact on the environment. Under the new guidelines, new plants processing 5 to 10 tonnes a day will be required to recover at least 90 per cent of their inlet sulphur, while plants processing 1 to 5 tonnes a day of sulphur will be required to recover at least 70 per cent. The Government has introduced a royalty credit, allowing operators of plants in the 1-to-5-tonnes-a-day range to recover up to half of the capital and incremental operating costs of the new sulphur removal equipment. New plants handling less than 1 tonne a day are not required to recover sulphur.

For large plants, the new sulphur recovery requirements range from 96.2 to 99.8 per cent, unchanged from previous regulations.

This is the third time the sulphur recovery guidelines have been revised since the early 1970s. The emphasis on improving recovery has also helped stimulate the development of new technology.

Shell Canada's huge Waterton complex, one of the largest sour gas processing plants in the world.

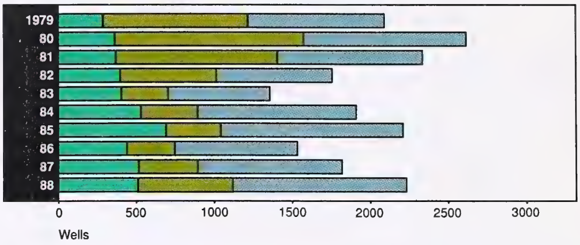
Alberta's Energy—A Historical Perspective

The following charts provide a 10-year perspective on Alberta's conventional oil, bitumen, and synthetic crude oil, as well as natural gas and sulphur activities.

4. Oil and Gas Wells
Exploration

Total exploratory wells drilled in 1988 were up about 20%, due primarily to gas exploration. The success rate remains about 50%.

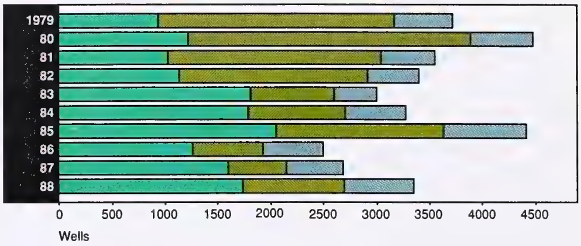
▨ Abandoned and Other



5. Oil and Gas Wells
Development

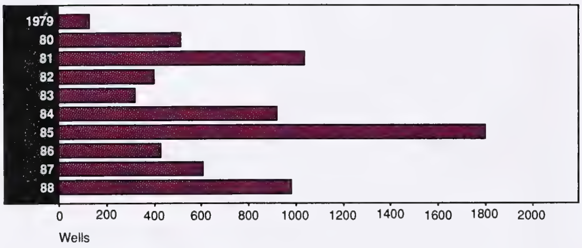
The number of development wells drilled in 1988 increased about 25% over 1987. The success rate continues at about 80%.

▨ Abandoned and Other



6. Oil Sands Wells

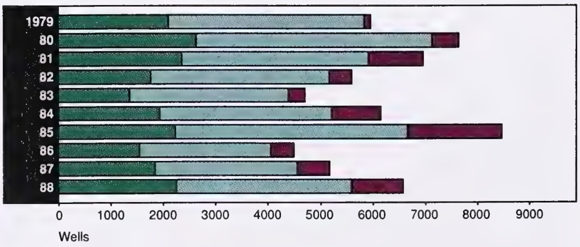
The drilling of oil sands wells was up 60% over 1987, but remained about half the peak level of 1985.



7. Total Wells Drilled

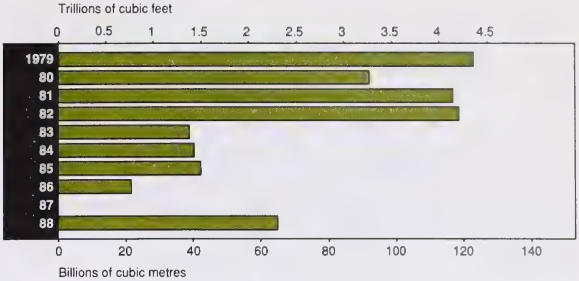
Total wells drilled in 1988 were up nearly 30% over 1987 due to incentive programs for oil and improved market prospects for gas.

- ▨ Exploration
- ▨ Development
- ▨ Oil Sands



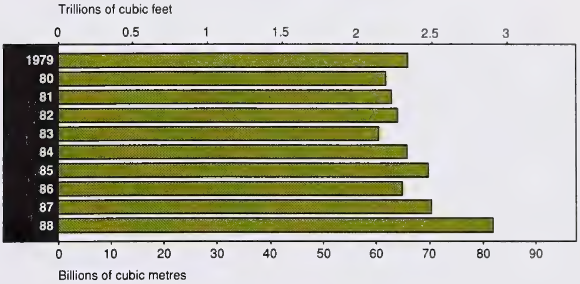
8. Additions to Established Gas Reserves

Drilling for natural gas added 65 billion cubic metres of reserves.



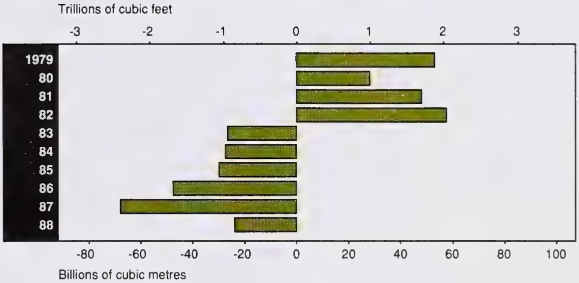
9. Gas Production

1988 saw record production of natural gas, up 16% over 1987.



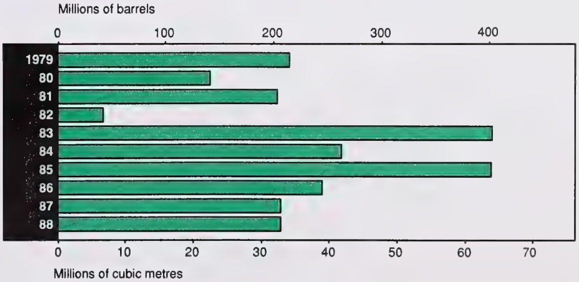
10. Changes in Remaining Established Gas Reserves

Reserves of natural gas continue to be used at a faster rate than they are being discovered, resulting in a net decline of more than 24 billion cubic metres.



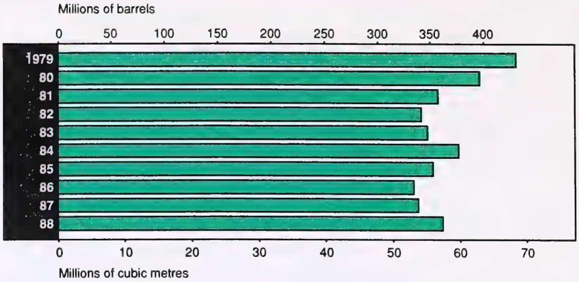
11. Additions to Established Oil Reserves

Alberta added more than 30 billion cubic metres of oil to reserves in 1988, about the same volume as was added the previous year.



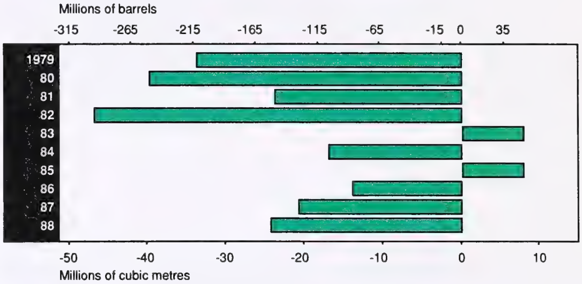
12. Conventional Oil Production

Conventional oil production in 1988 was up over the previous 3 years, but remains far short of the record 1979 year.



13. Changes in Remaining Established Oil Reserves

Conventional oil reserves declined by almost 25 million cubic metres in 1988, as production continues to exceed reserve additions.

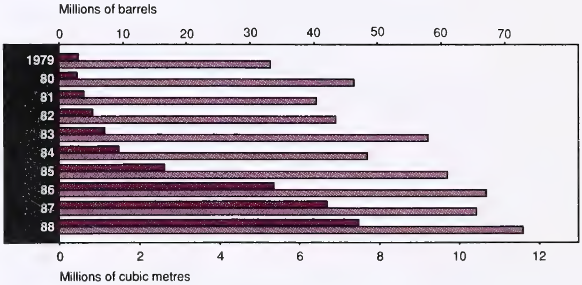


14. Bitumen and Synthetic Crude Oil Production

Alberta had a record year in 1988 for production of bitumen and synthetic crude oil. This is due to some growth in bitumen projects and good performance at Alberta's two synthetic crude oil plants.

■ Bitumen

▨ Synthetic Crude Oil



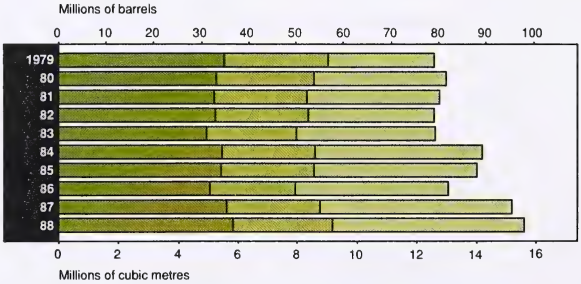
15. Natural Gas Liquids Production

Natural gas liquids production was up slightly in1988 as a direct result of increased gas production.

■ Propane

▨ Butanes

□ Ethane

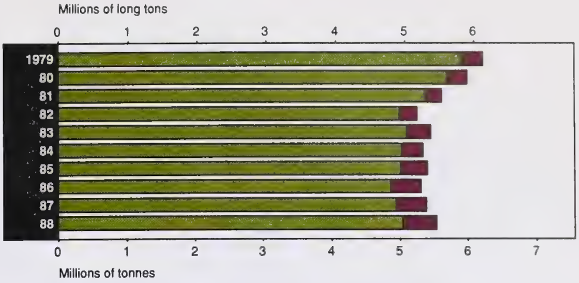


16. Sulphur Production

Sulphur production was up slightly, also resulting from increased natural gas production.

🟩 Gas Plants

🟥 Oil Sands Plants



Coal

Alberta's 1988 production of raw coal increased by 16 per cent over 1987 levels, to 33.4 million tonnes compared to 28.8 million tonnes last year. Deliveries of marketable coal increased by about 14 per cent, to more than 29 million tonnes. A number of international developments, including increased steel production in Japan, labour unrest in Australia, and widespread drought conditions in North America, which adversely affected hydroelectric generation, contributed to this increase in demand for Alberta coal.

This was the best year for Alberta's coal industry since 1980, when coal production and deliveries increased by 23 and 16 per cent, respectively. Offshore deliveries of bituminous metallurgical coal increased by 40 per cent, while bituminous thermal coal deliveries to Ontario and offshore markets increased by about 14 and 23 per cent, respectively. Subbituminous coal deliveries to electric power generating plants in Alberta were up about 7 per cent, because of the export of electric power and to increased domestic consumption.

Although international coal prices increased by about 7 per cent, the increased value of the Canadian dollar offset the increases received by coal producers for offshore export sales. In 1988, coal revenue was up substantially as a result of increased tonnage and prices, but the rising value of the Canadian dollar remains a significant concern. The markets for both domestic and non-Alberta coal sales are expected to remain strong through 1989.

The Genesee mine— a new joint-venture coal mine of Fording Coal Limited and the City of Edmonton's power utility, Edmonton Power— went into production in December 1988. The mine, 55 kilometres west of Edmonton, will supply coal to Edmonton Power's electric generating plant at Genesee, which is scheduled to be commissioned in October 1989. Genesee is the first new producing mine site in Alberta since August 1984, when Unocal Canada's Obed Mountain Mine near Hinton began production.

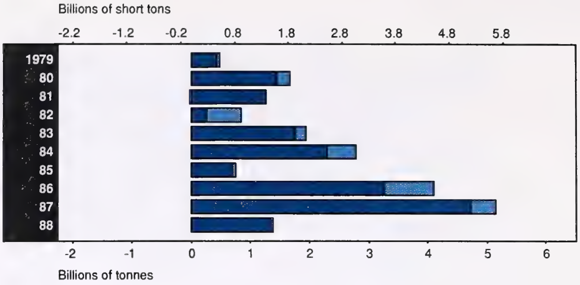
Coal exploration in 1988 showed an increase for the first time in 4 years, with 344 holes drilled, compared to 246 for 1987. However, coal markets have not yet come to the point where companies will begin opening major new mines.

17. Additions to Initial Established Coal Reserves

Alberta added almost 1.4 billion tonnes to its coal reserves in 1988, due almost entirely to increases in subbituminous coal reserves.

■ Subbituminous

▨ Bituminous

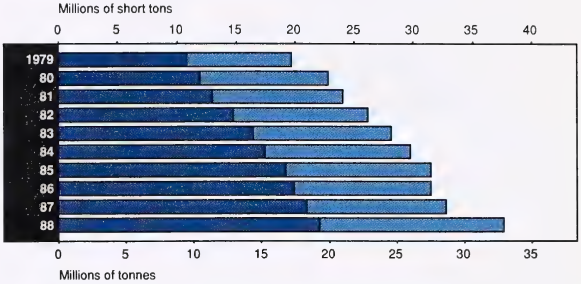


18. Coal Mine Production (Raw Coal)

Production in 1988 set new records, up almost 16%, with increases in both bituminous and subbituminous coal produced.

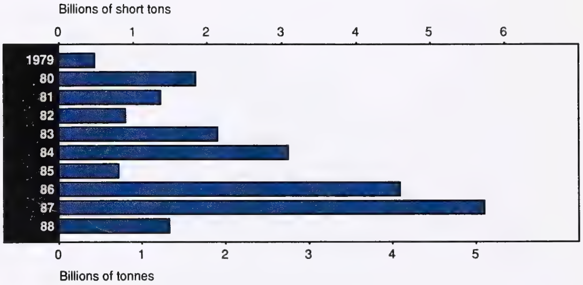
■ Subbituminous

▨ Bituminous



19. Changes to Remaining Established Coal Reserves

Alberta's coal reserves increased nearly 1.4 billion tonnes in 1988.



Electricity

The year 1988 saw significant activity in the area of electric generation from small, non-utility power production facilities.

In response to a request by the Alberta Government, a joint ERCB/ Public Utilities Board hearing into the matter of small power production was held in late 1987. A decision was released in early 1988.

The two Boards made joint recommendations to facilitate small power generation in the province, provided it does not increase costs to Alberta's electric consumers. The Government endorsed the recommendations from the inquiry and put in place a Small Power Research and Development Program to encourage electric generation by small power producers, based on renewable energy resources. The implementation of the small power policy by the Government required changes to the Hydro and Electric Energy Act and Regulations, publication of an informational brochure explaining the ERCB's process for handling small power applications, and the issuance of guidelines respecting information to be filed with applications for approval of small power facilities. At year-end the Board has received six applications for such developments, all of which involved hydro developments.

Of the various applications considered by the Board for approval to construct and operate electric transmission lines, two raised a relatively new and significant issue — the health effects associated with electric and magnetic fields produced by high voltage transmission lines.

In one instance involving a 138-kV line, the Board concluded that there would not be adverse health effects associated with the electric and magnetic fields of the proposed line. In the second instance, involving a 240-kV line in the Edmonton area, a decision has not yet been rendered.

Modifications to Bow River Dams

Some unusual hydro-engineering work, carried out in 1988, had to do with modifications being made to the hydro systems on the Bow River upstream of Calgary.

Downtown Calgary is built on the floodplain of the Bow. Thus, any major flooding could cause significant damage.

When the various Bow River hydro dams were built during the first half of this century, historical hydrological data were used to estimate the maximum flood level likely to occur. The modern outlook, however, is to view not only historical data, but to consider meteorological and

Alterations being made to the Ghost Reservoir Hydro Generating Plant, upstream of Calgary, are clearly visible on the right.

other data to estimate the probable maximum flood levels. Using this approach, flood flows higher than those for which the dams originally were designed have been calculated.

As a result, modifications have been undertaken to allow more water to flow over the dams during periods of unusually high runoff by increasing the capacity of the spillways at the Cascade, Ghost, and Bearspaw dams, all up-river from Calgary. The primary benefit of these modifications is to increase the safety of people living downstream of the plants, and to reduce the potential environmental impacts from inordinate rainfall.

Hydro plants currently represent 12 per cent of the province's generating capacity. However, in 1988 they generated only 4 per cent of the electric energy used in Alberta.

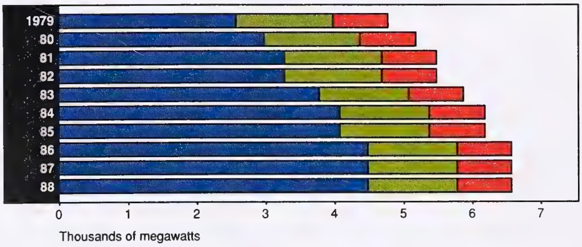
About 90 per cent of the electric energy required in Alberta is supplied by coal-fired plants and another 6 per cent by gas-fired plants. Future coal plants include the first unit at Genesee, which will be ready in the fall of 1989, the second unit at Sheerness, scheduled for the fall of 1990, and the second unit at Genesee, scheduled for the fall of 1991.

Another item of interest was the approval for a direct-current interconnection of the electric systems of Alberta and Saskatchewan. Alberta Power Limited was given approval to link its transmission system with that of Saskatchewan Power Corporation. Construction of the interconnection is on-going, with completion scheduled for 1989.

20. Electric Generating Capacity

Alberta's electric generating capacity remained constant.

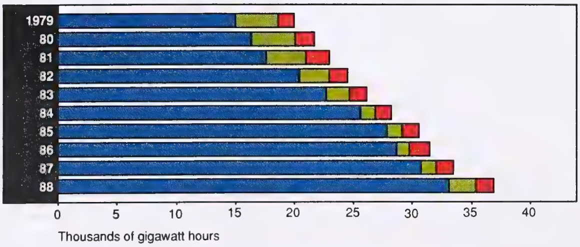
🟥 Hydro



21. Electricity Generated

Electrical energy demand grew by about 10% in 1988, with the increase accommodated largely by coal-fired thermal generation.

🟥 Hydro



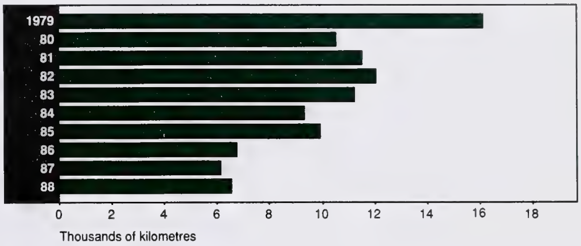
Pipelines

The ERCB processed 4400 pipeline applications during the year, of which 2100 were permit applications for new line. The remaining applications were for new operating licences, or for amendments to existing operating licences.

In total, Alberta pipeline construction during 1988 was 6600 kilometres, compared to about 6200 kilometres in 1987.

22. Pipeline Installed

Alberta added 6600 kilometres of pipeline in 1988, continuing the fairly low activity levels of the past 3 years.



NOVA Corporation had possibly its busiest year ever in 1988, constructing about 800 kilometres of additional pipeline for its Alberta gas-gathering and transmission system. The pipe ranged in size from 168.3 to 508 millimetres in diameter. As well, the company added 53 new gas receipt points, and new or expanded compressor capacity totalling 104 megawatts. This work, worth about $300 million, is part of a 4-year $1-billion expansion of the province's major gas pipelines.

Pipelines and People

Although many property owners are affected by pipeline construction each year, most of their concerns are resolved without ERCB public hearings. In 1988, the Pipeline Department staff assisted in resolving more than 50 landowner objections to pipelines, without going to hearing.

Sour Pipeline Inventory Being Developed

Alberta currently has 190 000 kilometres of oil and gas pipelines— the safest and least expensive way of transporting these valuable commodities from where they are produced to where they are needed. Although this amount of pipe is sufficient to girdle the globe four times, Albertans are mostly unaware of its presence. While the pipelines may be of little public concern, the need to be able to locate lines at any time is an important mandate for the Board.

Each pipeline in the province is licensed by the ERCB and details are kept on file in the Board's Records Centre. This information is correlated by company and by pipeline. On township maps a number is assigned to each pipeline. Using that number, one can trace the type and kind of any pipeline through the ERCB licence under which it operates. Computerizing this whole system will take some time.

A data base that can be run on a personal computer (PC) is being developed by the Board for those needing fast access to sour gas pipeline information.

At present, there are 188 different sour gas systems in the province and 4900 kilometres of pipelines carrying gas containing 10 mol/kmol (or more) of H_2S.

The need for a faster, computerized system has its origins in the setback requirements for sour gas pipelines. To promote public safety, the Board requires pipelines to be built certain distances from existing buildings, public use areas, and communities. The Alberta Planning Act requires that planners must also ensure that development is kept an equivalent distance from pipelines.

This means planners have to have easy access to data on pipelines, particularly those that carry sour gas. The Board has in place a procedure by which, upon request, a planning commission will be supplied with data on all sour gas pipelines in a given area. Currently, the information is extracted manually from the all-pipeline data base.

The objective of the new PC program is to document all sour gas pipelines in the province now, as a priority measure.

Data is currently being updated by surveying all sour gas operators and asking them to verify their records against those of the ERCB. Arrangements have also been made through the ERCB's permit application procedure so that new information can be fed routinely into the PC system.

Once the system is complete, the intention is to make the data readily available to planning commissions and others needing to know sour gas pipeline locations.

Salt Water Corrosion—a Growing Problem

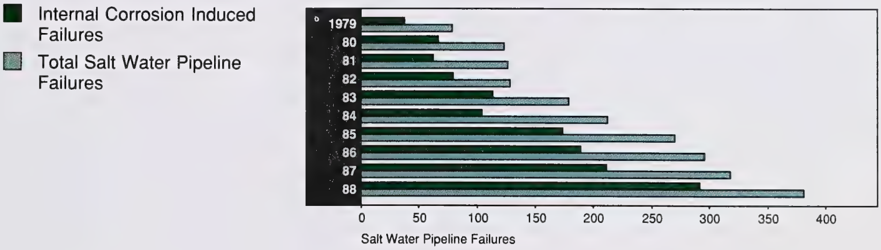
As Alberta's oil and gas fields age, the amount of produced water is on the increase. The increased volumes of salt water to be disposed of by injection into reservoirs present an increased risk of salt water pipeline failures due to internal corrosion.

Most of the conventional oil and gas in the province is in reservoirs where the oil is trapped in porous rock between a gas cap on top and salt water beneath. As the amount of oil decreases during production, there is a tendency for the amount of salt water mixed with the oil to increase. This tendency is particularly prevalent during enhanced recovery schemes.

Today, a great deal of salt water is being re-injected into reservoirs to maintain or enhance oil recovery levels. These salt water pipelines have a higher likelihood of encountering problems because they are typically operated at high pressures and move high volumes of water. As the amount of produced water increases, less and less fresh water is used in these enhanced recovery schemes which, in turn, increases corrosion problems.

A related problem is the difficulty of detecting leaks by automatic means in an injection scheme where dozens of pipelines might be involved in a single system, and where flow rates and pressures can vary dramatically.

Salt water is extremely corrosive, so operating companies have tackled the problem by internally protecting the steel pipeline. The most popular methods of protection are concrete coatings and polyethylene liners. To prevent a growing leakage problem it is important that internal pipe protection is applied properly. Internal corrosion is the largest single cause of salt water pipeline failures, as shown in the graph below.



A study covering the period from 1975 to 1988 showed that 151 Alberta fields experienced salt water pipeline failures and, of those 151 fields, 18 had more than 25 pipeline failures during that period.

Alberta First Call

Ever wonder about that First Call Number in the back of your telephone book?

It is there in part because of an ERCB inquiry into the 1979 pipeline rupture that forced the evacuation of 18 000 people from Millwoods in South Edmonton.

The unfortunate Millwoods event sparked widespread concern among Alberta pipeline and utility operators who, working with ERCB staff, began looking for a solution.

They quickly discovered that the most effective solution was the One Call system, pioneered in the United States. This work led to the formation in 1983 of the Alberta First Call Corporation(1), based in Calgary, with 12 founding shareholders. Today, Alberta is the only province in Canada having a One-Call notification system. The organization's first call was taken in October 1984– and the lines have never stopped ringing. The number of calls has risen from 67 000 in 1984-85 to more than 100 000 in 1988. The number of members has increased to more than 80.

First Call Is Vital!

A 1973 study by the U.S. National Transportation Safety Board found that more than 40 per cent of all pipeline accidents were caused by someone digging into pipelines. In 1 year alone, U.S. Bell companies reported cables had been damaged 87 000 times by dig-ups.

Electric utilities in the U.S. reported that 86 per cent of their underground service failures were caused by dig-ups. In one city alone, 4000 water main breaks were experienced over a 5-year period.

ALBERTA 1st CALL

In 1979, Alberta suffered 8600 damage incidents caused by excavation activity. The cost to repair the damage exceeded $4 million, not including property damage, personal injury, legal fees, and administration charges.

So the Board's advice is, call before you dig! When you do call 1-800-242-3447, the fact that you plan to dig will be routed to all First-Call members in your area and you will be told who they are. They will come out to locate and mark pipelines and other utilities, and will tell you how deep their facilities are buried.

Keep in mind, though, it is up to the property owner or contractor to ensure that non-member pipeline or utility owners in the area also have been notified. And the onus is always on the excavator to dig with care.

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(1) *Alberta uses "First Call" to indicate that more calls might be required, because not every potential utility or pipeline member has as yet signed up.*

Sales and Distribution

While conventional oil production held its own in 1988, at about 57.5 million cubic metres—being the third highest production level of the 1980s—bitumen and synthetic crude oil production reached an all-time high of more than 19 million cubic metres. Thus, total crude oil and equivalent sales registered their highest level of the last decade, at 83.5 million cubic metres. This is attributable, in large part, to the first full year of operation with the expanded Interprovincial Pipe Line (IPL) system and the Modified Proration Plan, both of which contributed to easier access to markets. However, on-going capacity problems of IPL suggest that increases in supply in the future will likely require some expansion of extraprovincial trunk lines.

Alberta's natural gas sales achieved record levels in 1988, with marketed gas totalling 77 billion cubic metres. Total sales in 1988 were 15 per cent higher than in 1987 and 13 per cent higher than the previous record year of 1985. With declining continental oversupply of natural gas, accompanied by major regulatory changes, Alberta's natural gas exports to the United States jumped substantially, from about 24 billion cubic metres in 1987 to about 33 billion cubic metres in 1988. Increased exports to the United States accounted for 90 per cent of the increased 1988 sales. NOVA and TransCanada PipeLines both announced their intention to make major expansions to their systems in the next few years.

Sulphur sales increased by some 16 per cent over the 1987 level and stood at almost 8 million tonnes. Total sales were more than a million tonnes higher than in 1987, with most of the increase coming out of inventory.

Sales of Alberta coal in 1988 were the highest they have ever been, coming in at slightly more than 29 million tonnes. Sales to the rest of Canada rose about 10 per cent, and subbituminous coal sales within Alberta increased by about 7 per cent over the previous year. Total export sales in 1988 were almost 40 per cent higher than in 1987, the majority being metallurgical exports to Japan.

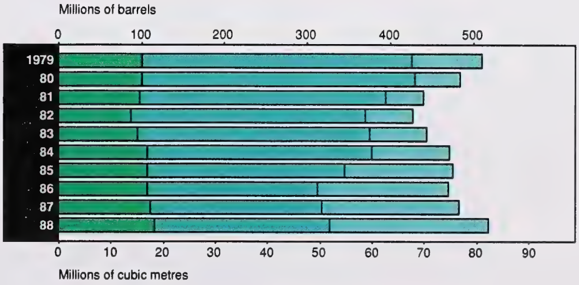
23. Markets for Oil and Equivalent

Alberta experienced its best year ever in 1988 for sales of oil and equivalent. Sales to the U.S. were up 15%, with smaller increases to Alberta refineries and elsewhere in Canada.

🟩 Alberta

🟩 Other Canada

🟩 U.S.A.



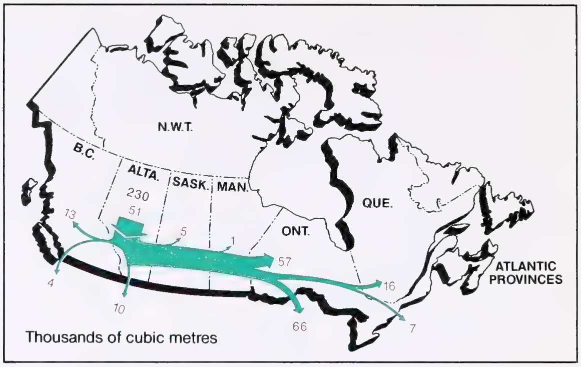
24. Markets for Oil and Equivalent in 1988

The major increase in sales was into the U.S. Midwest market, up more than 20% over 1987 sales.

Legend

Production

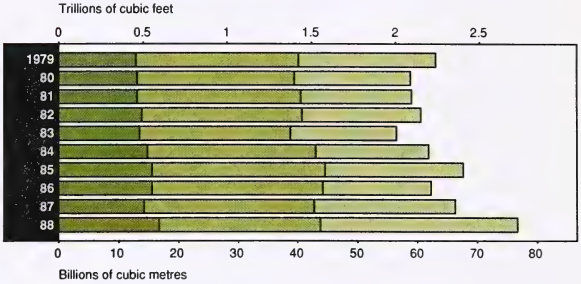
Deliveries



25. Markets for Gas

Natural gas sales in 1988 increased over 15%, with major increases to the U.S. and a slight decline in sales to Central Canada.

- ■ Alberta
- ■ Other Canada
- ■ U.S.A.



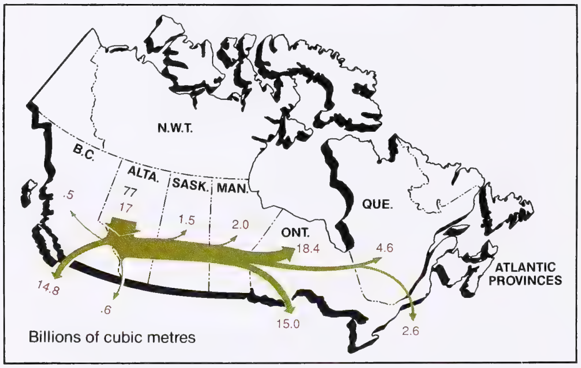
26. Markets for Gas in 1988

Alberta consumed 22% of the gas it produced in 1988, with the U.S. now taking more than 40% of the province's total production.

Legend

Production

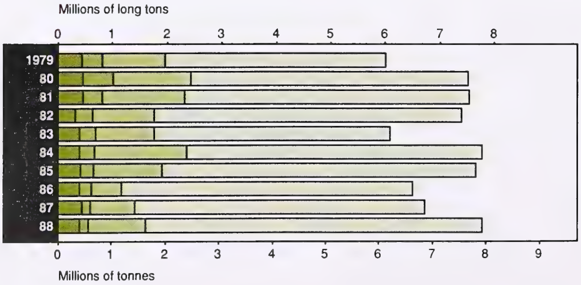
Deliveries



27. Markets for Sulphur

Sulphur sales in 1988 were at near-record levels, with a significant inventory drawdown in order to meet export requirements.

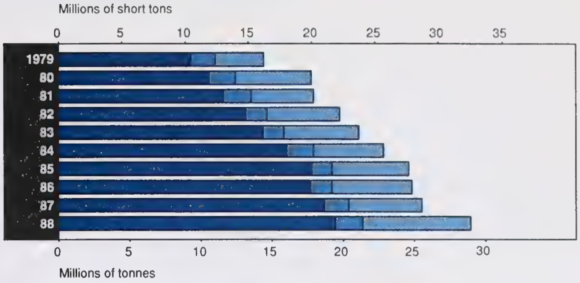
- ■ Alberta
- ■ Other Canada
- ■ U.S.A.
- □ Offshore



28. Markets for Coal

Alberta had a record year in coal sales because of increased electrical generating demand inside the province and improved offshore sales.

- ■ Alberta
- ■ Other Canada
- ■ Offshore



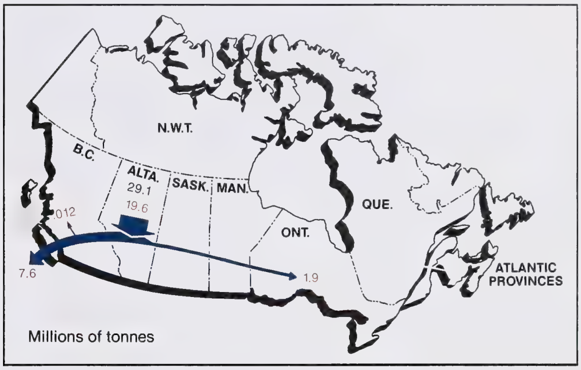
29. Markets for Coal in 1988

Alberta continues to consume two-thirds of the coal it produces, with Japan continuing to be the major offshore market.

Legend

Production

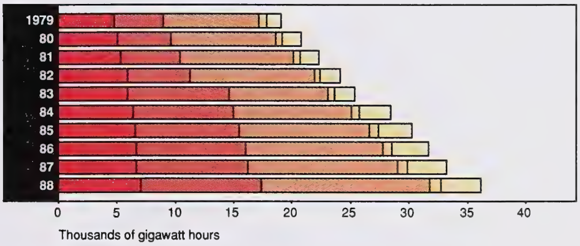
Deliveries



30. Electric Energy Markets

All sectors of the electric energy market expanded relatively constantly, reflecting an increase in the overall economic growth of the province.

- ■ Residential and Farms
- ■ Commercial
- ■ Industrial
- ■ Transportation
- ☐ Industrial On-site Generation



Revenues, Investment, Employment

Sales Revenues

Revenue estimates for Alberta's 1988 energy sales totalled some $16.4 billion, a decrease of 5 per cent from the previous year.

Despite a surge in crude oil and equivalent production, low prices—exacerbated by a strong Canadian dollar—caused crude oil and equivalent revenues to drop by $1 billion, to $9.9 billion.

While 1988 saw record marketable gas sales, revenues increased by only 5 per cent to $4.4 billion, held down by lower gas prices.

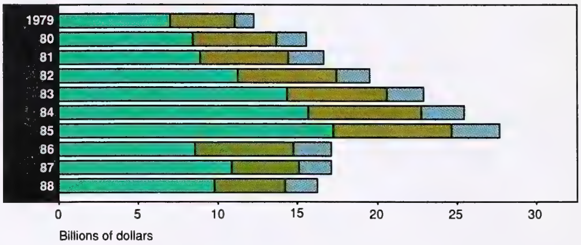
Sulphur revenues were up 4 per cent to more than $600 million, despite lower sulphur prices, reflecting a 4-year high in sales volumes.

Revenues for coal were up marginally, to about $430 million, as coal prices firmed and sales expanded, particularly to offshore markets.

31. Gross Revenues
All Hydrocarbons

Despite record increases in production and sales in 1988, gross revenues to the energy industry were at their lowest levels since 1980.

▨ Other



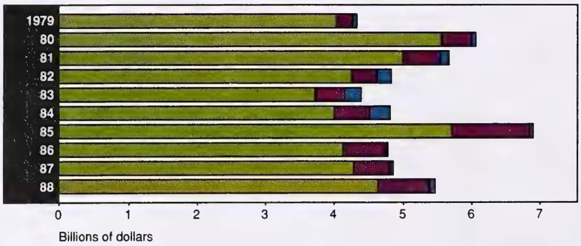
Investment

The energy industry's capacity to invest is, with some delay, affected significantly by swings in energy commodity prices. Despite lower oil and gas prices in 1988, total energy investment in Alberta is estimated to have increased by some 12 per cent, to more than $5 billion, reflecting a level of investment based on relatively buoyant prices in the preceding year. A prime motivating factor for investment in the gas industry was the marked increase in United States demand for Alberta gas. In total, investment in conventional oil and natural gas is estimated to have increased by 8 per cent, to $4.7 billion, while investment in oil sands reversed its 3-year downward trend, and coal investment nearly doubled.

32. Energy Investment in Alberta

Investment in the energy sector was up in 1988.

🟩 Gas and Conventional Oil
🟥 Oil Sands
🟦 Coal

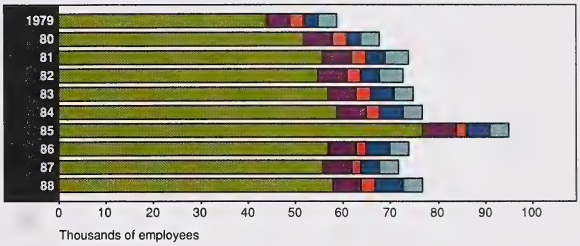


Employment

Employment in Alberta's energy sector recovered slightly in 1988, reversing a modest decline in the previous year. Demand for workers in the oil and gas industry increased in anticipation of expanding market opportunities, particularly with regard to the increased utilization of existing petrochemical capacity. Increased coal demand also sparked employment in Alberta's coal industry.

33. Employment in Alberta's Energy Industry

Employment in the energy sector was up slightly in 1988.



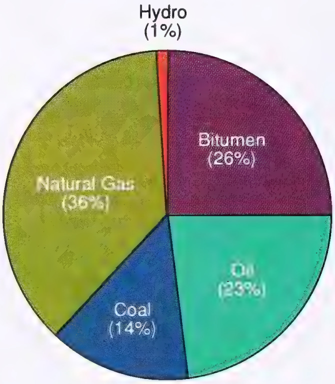
Not only do significant numbers of adult Albertans find work in the energy industry, but younger free-enterprisers also thrive in the industry.

Alberta Energy in Perspective

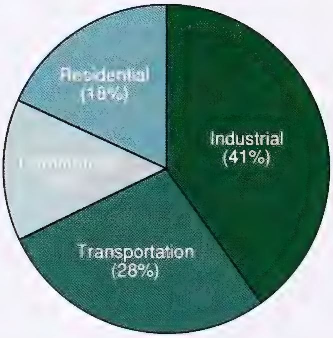
Alberta remains the major source of energy for Canada and a significant exporter to United States and offshore markets. The energy resources used to meet Alberta's own requirements in 1988 are shown in Figure 34. The percentage of each end-user category is shown in Figure 35.

The industrial sector remains the largest single consumer of energy in Alberta and, as shown in Figure 36, this section is expected to grow at the fastest rate in the future. The remaining three sectors of the provincial economy are experiencing somewhat lower rates of growth, reflecting continued improvements in the efficiency of energy use by consumers, balanced against projected growth in population.

34. **Energy Resources to Meet Alberta's End-use Requirements—1988**

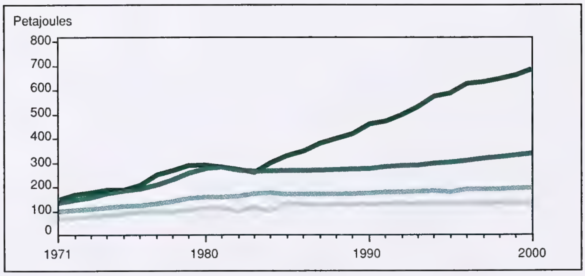


35. **1988 End-use Energy Requirements in Alberta**



36. **Secondary Energy Requirements by Sector**

The ERCB forecasts there will be modest growth in the transportation, commercial, and residential sectors, with considerable growth in the industrial sector between now and the year 2000.



- Industrial
- Transportation
- Residential
- Commercial

Alberta in the Canadian Energy Picture

The major portion of Canada's known reserves of oil, natural gas, bitumen, and coal are located within Alberta. Table 37 shows national distribution of Canada's known energy resources.

Despite significant increases in potential oil reserves, the conventional oil supply is expected to decline to less than half the current levels of production by the end of the century, as production continues to outstrip new discoveries. It is expected, however, that the decline will be more than offset by additional production from new or expanded synthetic crude oil and crude bitumen projects. It is also anticipated that projected price increases should allow synthetic crude oil production to double by the beginning of the next century, and bitumen production to triple in the same period.

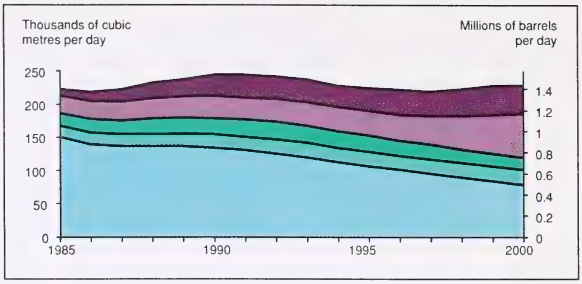
The prospects for natural gas production appear buoyant through to the next century.

37. Alberta vs Canadian Reserves and Production (in petajoules)

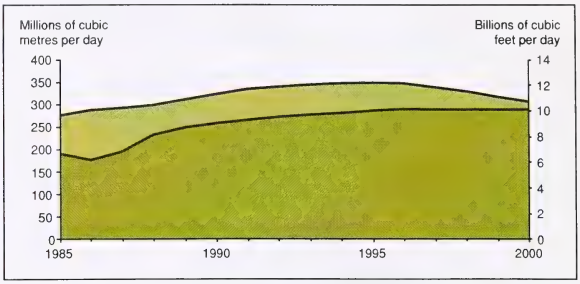
Remaining reserves at the end of 1988	Alberta	All of Canada	Percentage Reserves in Alberta
Conventional Oil and Equivalent	22 400	29 000	77
Natural Gas and Equivalent	63 000	69 000	91
Bitumen and Synthetic Crude Oil	153 000	153 000	100
Coal	573 000	1 018 000	56
Total	**811 400**	**1 269 000**	**64**

1988 Marketable Production (estimated)	Alberta	All of Canada	Percentage Production in Alberta
Conventional Oil and Equivalent	2 450	3 050	80
Natural Gas and Equivalent	3 200	3 700	86
Bitumen and Synthetic Crude Oil	735	735	100
Coal	640	1 680	38
Hydro	5	1 100	1
Nuclear	0	290	0
Total Production	**7 030**	**10 555**	**67**

38. Oil and Equivalent Supply 1985-2000



39. Gas Capacity and Production 1985-2000

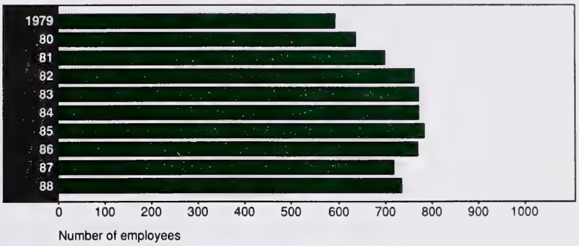


A trainload of Alberta coal snakes its way over the mountains on its way to Pacific Rim markets.

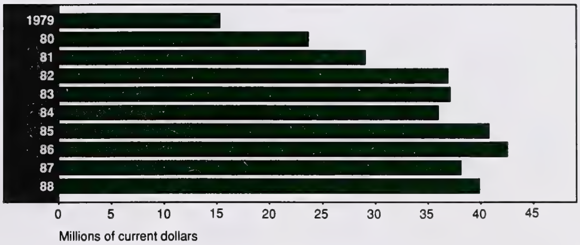
ERCB Operations

Despite major increases in its total workload— including significant involvement with the Alberta public, as well as work on two relatively new areas described in this section— the ERCB allowed only modest increases in total expenditures and manpower. Total expenditures in 1988 were $40.1 million compared to $38.4 million in 1987, while total staff increased slightly, from 723 in 1987 to 739 in 1988.

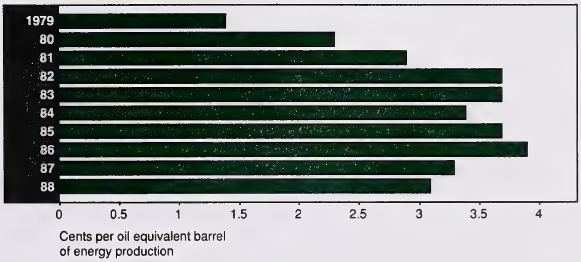
40. ERCB Staff



41. ERCB Expenditures



42. ERCB Expenditure Index



ERCB Staff Working with People

When it comes to new Alberta energy developments, the trend continues towards increased concern on the part of directly-affected residents and communities and, subsequently, more direct public involvement for many ERCB staff, with particularly heavy emphasis on its front-line field people.

Today, ERCB's staff are increasingly involved in trying to improve communications with the public, with industry, and between industry and the public.

Particularly, its field staff act as a catalyst to get communications started.

In the Board's view, setting up a proper communications program, and working to resolve potential issues before they become problems, pays off in the longer term.

One approach being explored by the ERCB is for industry to set up public involvement/information co-operatives, similar to the oil spill co-operatives which have operated successfully in the province for a number of years. These co-ops could then share in the handling of public concerns, in communication and information exchanges with the public, and in dealing with issues of special sensitivity. The co-ops could also keep members informed regarding the "pulse" of individual communities, judging what issues and concerns may be in need of public discussion and input.

The Provost Heavy Oil Operators Committee, for example, was set up in March 1988 as a result of growing public concerns with oil development activity in that area. Committee members now share experience and expertise on controlling odours and noise, and on other environmental issues. For example, the committee presently is developing a trucking policy aimed at standardization of field equipment and trucks. These procedures, combined with a proactive community relations and public information program, have led to greatly improved relations between the producers and residents in the area.

Surveillance Is Necessary

To improve the accounting of the Crown's share of Alberta oil revenues, the Board increased its surveillance operations during 1988. This new thrust was generated by a task force set up jointly between the ERCB, Alberta Energy, and the Alberta Petroleum Marketing Commission. The objective is to improve and verify the accuracy of production measurement and reporting in the province, particularly as it relates to the province's share of resource revenues.

ERCB's Drilling and Production Department added four people to its staff during 1988 in connection with this program. Also, two more people were hired whose primary function is examination of the fraudulent aspects of production reporting. To improve ERCB's surveillance systems, these specialist staff members are looking at three key areas:

1. Proration test verification and application of that information to individual well production.

2. Improvement to production measurement, with an on-going review of conventional and enhanced recovery measurement methods and accuracies.

3. Checks of the calibration of metering equipment by Board staff in the field. A directive was issued to industry in 1988 regarding this program and the work has begun, with Drilling and Production staff finalizing design of the equipment needed to do the calibration.

New Oil Field Battery Guide

The Drilling and Production Department also has initiated a new battery application guide to streamline the process for both the Board and industry. Issued in March of 1988, the new guide (G-35– Guide for Completing a Production Facility Application) is now in widespread use. The guide simplifies the requirements for single-well facilities and further clarifies the requirements for other kinds of production facilities.

There were 1344 single-well batteries approved by the ERCB during 1988, plus 57 multi-well batteries, 16 multi-well sour facilities, and 50 single-well sour facilities.

Sour Wells Raise Concerns

Sour gas has generated a significant increase in the public involvement work of ERCB staff over the past few years as it relates to the licensing of sour wells in general, but more particularly to the licensing of critical sour wells.

This has been caused by a combination of factors, including increased public awareness, increased ERCB requirements for public notice and involvement, and the general increase in industry activity related to the development of sour gas (sulphur) reserves. In 1985, for example, there were only 31 critical sour wells licensed by the ERCB while in 1988, 75 critical sour wells were approved. Critical sour wells are those which generally represent a higher public risk and require special safety precautions during drilling and production.

It is important to ensure the public is properly informed as to the nature of the well being drilled, the potential surface development restrictions associated with the well, and contingency plans to deal with an emergency situation should one occur (emergency response planning). Critical sour wells involve extensive ERCB, industry, and government contact with all people who may be directly and adversely affected, from initial meetings with landowners and occupants through to full public meetings and open houses. They also involve very extensive technical reviews by ERCB staff of the proposed drilling and emergency response plans for the wells.

As of the end of 1988, a total of 208 critical wells have been licensed and the number of proposed critical wells per year has increased annually for the last several years. To date there have been no serious incidents at any of these specially-licensed critical wells.

Orphan Wells Need Attention

Under normal circumstances, a company in whose name a drilling licence is held is responsible for all work related to both the operation and abandonment of the well. However, sometimes wells become "orphans". An orphan well is an oil or gas well where there is no known ownership, with responsibility for it having passed to the Crown. This becomes a major concern with wells that are leaking or not properly abandoned. The Board then must assume responsibility for doing the necessary work.

During 1988, the ERCB worked on three orphan wells and spent in excess of $500 000 dealing with them.

The Board presently has about 50 true orphan wells on the books that it will have to deal with at some point. They are virtually all old wells, drilled in the 1940s and 1950s.

However, there are about 24 000 inactive or suspended wells in the province, an undeterminable number of which have the potential to become orphans. An industry/Board task force has been struck to look at the best ways of dealing with these orphans so they will not become problems. Presently, there are about 200 wells in limbo because of companies being in receivership, with ultimate ownership still an unknown.

The Board administers a $3-million fund set up to deal with orphan wells. To date, the interest income from this fund has been used to carry out the Board's work on the program.

Talk about finding an "orphan" on your doorstep! This rig is working, under contract to the ERCB, to solve the problem of an "orphan" well that has come back to life almost in downtown Medicine Hat.

ERCB's Management Team

Board Member Chris Goodman retired during 1988. There now are two vacancies on the seven-member Board.

Board Members

G. J. DeSorcy	Chairman
N. A. Strom	Vice Chairman
F. J. Mink	
E. J. Morin	
J. P. Prince	

Managers

Accounting	R. T. Bording
Administrative Services	K. G. Sharp
Coal	R. G. Paterson
Communications	J. K. Bales
Data Processing	H. Antonio
Drilling and Production	J. R. Nichol
Economics	J. W. Newton
Employee Relations	R. F. Braun
Environment Protection	E. R. Brushett
Field Operations	W. G. Remmer
Gas	J. D. Dilay
Geology	C. A. Langlo
Hydro and Electric	T. F. Homeniuk
Legal	M. J. Bruni
Oil	N. G. Berndtsson
Oil Sands	R. G. Evans
Pipeline	E. G. Fox

Additional information on the ERCB and its activities can be obtained from:

1.	Information Services	403-297-8190
2.	ERCB Library	403-297-7380
3.	Communications	403-297-3757

All three information sources are located in the ERCB Head Office at 640 - 5 Avenue S.W., Calgary, Alberta, T2P 3G4.

Energy Resources
Conservation Board
640 Fifth Avenue SW
Calgary, Alta. T2P 3G4